

CLAIMS

What is claimed is:

- 1 1. A computer system, comprising:
2 a plurality of computers, each computer capable of being in one of a plurality of power
3 states; and
4 a load balancer and power management logic coupled to said computers and to a network,
5 wherein said load balancer and power management logic changes the power state of
6 at least one of said plurality of computers based on transactions on said network.
2. The computer system of claim 1 wherein said network comprises the Internet.
3. The computer system of claim 1 wherein said load balancer and power management logic
determines when the amount of transactions on said network drops below a threshold and when
this occurs changes the power state of at least one of said plurality of computers to a state that uses
less electrical power.
- 1 4. The computer system of claim 3 wherein said state that consumes less power is the state in
2 which the computer is off.
- 1 5. The computer system of claim 3 wherein said state that consumes less power is the state in
2 which the computer is operational but with diminished capability.

1 6. The computer system of claim 1 wherein said power state includes a state selected from the
2 group consisting of fully operational, reduced power, and off.

1 7. The computer system of claim 6 wherein in said reduced power state the computer is
2 operational at diminished capacity.

1 8. The computer system of claim 1 wherein said load balancer and power management logic
2 provides transactions from said network to said plurality of computers and considers how fast each
3 of said computers responds to said transactions when changing the power state of a computer.

1 9. A computer system, comprising:
2 a load balancer computer having a connection to a network and receiving transactions from
3 said network;
4 a master power management agent (PMA) coupled to said load balancer;
5 a plurality of transaction processing computers coupled to said load balancer computer and
6 said master power management agent and receiving said transactions from said load
7 balancer computer for processing, each of said transaction processing computers
8 having multiple power states;
9 wherein said master PMA determines when a specified condition is true and when said
10 condition is true causing the power state of a transaction processing computer to
11 change.

1 10. The computer system of claim 9 wherein said condition includes the rate of transactions
2 received by the load balancer from the network falling below a threshold.

1 11. The computer system of claim 10 wherein said master PMA selecting a transaction
2 processing computer to change its power state based on how fast the transaction processing
3 computer responds to transactions from said load balancer.

1 12. The computer system of claim 11 wherein each of said transaction processing computers
2 report how fast the transaction processing computer responds to said transactions to said master
PMA.

1 13. The computer system of claim 11 wherein said load balancer monitors how fast each of
2 said transaction processing computers respond to transactions.

1 14. The computer system of claim 9 wherein each of said transaction processing computers
2 includes slave PMA software that causes said transaction processing computer to respond to
3 commands from said master PMA to change power state.

1 15. The computer system of claim 9 wherein if said condition is true, said master PMA causes
2 the state of a transaction processing computer to change to a state that draws less power.

1 16. The computer system of claim 15 wherein said state that draws less power is the off state.

1 17. The computer system of claim 16 wherein said transaction processing computer in said off
2 state can be woken remotely by a command from said master PMA.

1 18. The computer system of 15 wherein said state that draws less power is a state in which the
2 said state that draws less power is operational, but at reduced functionality.

1 19. The computer system of claim 18 wherein said transaction processing computer includes a
2 disk drive and said reduced functionality includes turning off said disk drive.

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3 said first network over which said transactions are delivered to the transaction processing
4 computers for further processing.

1 23. The data center of claim 21 wherein each transaction processing computer includes power
2 control logic which provides power usage information to said master PMA.

1 24. The data center of claim 21 wherein each transaction processing computer includes power
2 control logic which can transition the transaction processing computer from one power state to
3 another.

1 25. The data center of claim 21 wherein said master PMA transitions said transaction
2 processing computers between power states, said power states selected from the group consisting
3 of fully operational, reduced power and off.

1 26. A data center, comprising:
2 a master power management agent (PMA) coupled to a first network;
3 a plurality of transaction processing computers coupled to first network;
4 wherein a user via said management control console can specify a performance criterion for
5 said data center and said master PMA minimizes the overall power usage of the
6 data center for the specified performance criterion.

1 27. The data center of claim 26 further including a load balancer computer having a connection
2 to a second network over which the load balancer computer receives transactions and coupled to

3 said first network over which said transactions are delivered to the transaction processing
4 computers for further processing.

1 28. The data center of claim 26 wherein each transaction processing computer includes power
2 control logic which provides power usage information to said master PMA.

1 29. The data center of claim 26 wherein each transaction processing computer includes power
2 control logic which can transition the transaction processing computer from one power state to
3 another.

1 30. A method of managing power in a computer network which includes a plurality of
2 computers, comprising:
3
4 (a) monitoring a parameter associated with the network;
5
6 (b) determining when said parameter falls outside a defined range; and
7
8 (c) if said parameter falls outside a defined range, changing a power state of at least
9 one computer.
10

1 31. The method of claim 30 wherein said parameter includes the rate of transactions received
2 by said computer network.

1 32. The method of claim 31 wherein said range includes a threshold below which said
2 changing step is performed.

1 33. The method of claim 30 wherein (c) further includes selecting the computer that performs
2 transactions slowest as the computer for changing a power state.

1 34. The method of claim 30 wherein the power state of the computer after (c) is performed
2 comprises a state in which said computer consumes less power than the power state of said
3 computer before (c) is performed.

1 35. A computer system, comprising:
2 a plurality of computers coupled together over a network, each computer capable of being
in one of a plurality of power states; and
power management logic coupled to said computers and to said network, wherein said
power management logic changes the power state of at least one of said plurality of
computers based on a protocol.

1 36. The computer system of claim 35 wherein said protocol includes a time sequence in which
2 computer system power usage is specified for certain periods of time and said power management
3 logic adjusts the power states of said computers to conform with said time sequence.

1 37. The computer system of claim 36 wherein said power management logic selects a
2 computer to transition to a new power state based on the performance of said computer relative to
3 other of said computers.

1 38. The computer system of claim 35 wherein said protocol includes a time sequence in which
2 computer system power usage is specified for certain periods of time and a rule which specifies a
3 limit of system behavior.

1 39. The computer system of claim 35 wherein said protocol includes a time sequence in which
2 computer system power usage is specified for certain periods of time, a rule which specifies a limit
3 of system behavior and adaptive learning based on temporal performance of the computer system.

1 40. The computer system of claim 35 wherein said protocol includes maintaining the power
draw of the system below a threshold while maximizing performance.

1 41. The computer system of claim 35 wherein said protocol includes maintaining the heat
dissipation of the system below a threshold.

1 42. The computer system of claim 35 wherein said protocol includes maintaining the heat
dissipation of the system below a threshold while maximizing performance